STATEMENT OF DR.WAYNE MCILWRAITH

Before the
SUBCOMMITTEE OF COMMERCE, TRADE AND CONSUMER PROTECTION
COMMITTEE ON ENERGY AND COMMERCE HEARING ON

"BREEDING, DRUGS, AND BREAKDOWNS:
THE STATE OF THOROUGHBRED HORSERACING AND THE WELFARE OF THE THOROUGHBRED RACEHORSE"

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INTRODUCTION

By way of introduction I am Professor of Surgery and Director of the Gail Holmes Equine Orthopaedic Research Center at Colorado State University. I also hold the Barbara Cox Anthony University Endowed Chair in Orthopedics at CSU. I consult world-wide as an equine orthopedic surgeon and therefore am involved in the immediate repair and treatment of equine musculoskeletal injuries, as well as trying to find better answers for both fatal orthopedic injuries, as well as day to day orthopedic problems in the horse through our research program at CSU. I am also a past-President of the American Association of Equine Practitioners and the American College of Veterinary Surgeons (the Specialty Board for Veterinary Surgery). I participate in the AAEP "on call" program and Dr. Larry Bramlage and I act as the AAEP "On Call" veterinarians at the Annual Thoroughbred World Championships/Breeder's Cup races. I also participated in the Grayson-Jockey Club Foundation sponsored Welfare Safety Summits in October 2006 and March 2008 and am Chair of the Subcommittee on Race Track Surfaces.

This collective experience is the basis for my statements and comments that follow. I will restrict my comments to areas where I either have some expertise or research

findings, clinical experience or consensus of my peers. There are two parts to my discussion on each issue.

1. Factors that are purported to be of significance to the welfare of the Thoroughbred race horse.
2. What we have been doing and are doing to decrease injuries through research and strategic planning.

Thoroughbred horses can suffer catastrophic injuries during racing or training. This wastage was first recognized in the literature twenty-five years ago. Severe physical demands are placed on the musculoskeletal system of horses during the high-speeds reached during racing and training. Because of the importance of musculoskeletal injury there has been considerable interest in studying factors that predispose to such injuries and efforts have been directed to this area since the mid-1980s. The Mission Statement of the Orthopaedic Research Center at Colorado State University is to investigate the pathogenesis, diagnosis, treatment and prevention of musculoskeletal disease and injury for the betterment of both animals and humans. We have five research focuses and all of them are relevant to the issue of the welfare of the racing Thoroughbred. They include:

1. Joint tissue healing
2. Early diagnosis of bone and joint disease
3. Continued development of novel therapies for traumatic synovitis, capsulitis and osteoarthritis in the horse
4. Improvement in the understanding of the pathogenesis of exercise-induced traumatic disease

5. Investigation of rehabilitation and physical therapy techniques for musculoskeletal disease.

FACTORS OF SIGNIFICANCE OR RELEVANCE TO MUSCULOSKELETAL INJURY

1. Racing Thoroughbreds Have Fewer Starts Now Than Previously

There has been a working hypothesis that Thoroughbreds are less sound and durable than before. The evidence is that there are fewer starts per horse and shorter careers now. In 1950 Thoroughbreds in the United States and Canada raced an average of 10.9 times per year. By 1960, that average peaked at 11.31 races per year. By 2007 it had fallen to 6.31 races per year. Some believe this is evidence that the Thoroughbred breed is weakening. Certainly, such data implies that racing Thoroughbreds are less durable, but factors such as increased competition demanding increased levels of training and more stress on the musculoskeletal system also have to be considered. A global approach to examine all possible factors for the decreased number of starts is appropriate.

2. Racing 2-year Old Horses

A common opinion advanced in recent weeks (and indeed many years prior to that), is that the solution to musculoskeletal injury in the racing Thoroughbred is eliminating 2-year old racing. The Jockey Club recently released data retrospectively looking at the 1997 Thoroughbred foal crop in North America (Steeplechase racing excluded)**:**

Total Numbers Followed

NA Starters	2-year old	3-year old	4-year old and up
23,031	10,920	9,861	2,250

Average lifetime starts according to age when first started

2-year old	3-year old	4-year old and up	Overall
24.58	8.66	12.32	20.85

Average lifetime starts when first started as 2-year old (excluding starts as a 2-year old): 21.04

This last figures provides evidence that the horse's career after its 2-year old year, when started as a 2-year old, was still superior (and considering number of lifetime starts) compared to horse's that were started at 3 years of age or older.

In further support of these data, Drs Chris Kawcak and I at Colorado State University participated in a collaborative project in New Zealand (two collaborators from Massey University in New Zealand, two collaborators from the Royal Veterinary College in London and two collaborators from the veterinary school at Utrecht in Holland). The hypothesis of this research was that exercising foals and yearlings to strengthen their musculoskeletal system could improve their ability to stand up to the rigors of racing later. The results confirmed that, if done correctly, exercising the very young horse (and also exercising a 2-year old) is beneficial in strengthening the horse's musculoskeletal system and decreasing the risk of long-term injury. As background, it has been recognized for considerable time that when a horse goes into exercise (no matter what the age) there is necessary remodeling of the bones (and also the articular cartilage, ligaments and tendons) to increase strength. Initial work was done by Dr. Daniel Nunamaker at the

University of Pennsylvania finding that short, faster exercise could help decrease "bucked shins", which are a manifestation of the remodeling process to strengthen bone. Results from New Zealand showed that foals which were cantered starting at 3 weeks of age and went through an increasing controlled exercise program up to 18 months of age showed improvement in the condition of the articular cartilage in the joint. Most importantly it was shown that there were no deleterious effects on bone, tendon, or any other musculoskeletal structure with this early exercise regime.

3. The Presence of Prior Damage Leading to Catastrophic Injury and Early Recognition of This Damage is Critical to Fracture Prevention

There is an accumulating body of evidence for the presence of microdamage (this term includes change associated with remodeling, as well as direct microcracks and diffuse damage in the matrix of the bone under the joint surface) leading to the catastrophic fractures that we see in the fetlock joint (these include condylar fractures and biaxial sesamoid fractures that cause collapse of the suspensory apparatus). These studies are summarized as follows:

a) Recognition by Dr. Roy Pool at UC Davis that intra-articular fractures (fractures in the joint) were pathologic fractures i.e. they occurred in already diseased bone
b) Recognition by Dr. Sue Stover at UC Davis based on examining necropsy material from the California Post-mortem Program that stress fractures lead to complete fractures in the humerus
c) Experimental production of early microdamage with exercise in work done by Dr. Chris Kawcak and our group at CSU

d) Initial demonstration by Dr. Chris Riggs and co-workers at the Royal Veterinary College in London that linear defects in the mineralized cartilage and subchondral bone in the palmar/plantar aspect of the parasagittal groove adjacent to the sagittal ridge of the distal metacarpus were closely related to change in ossification pattern in the subchondral bone and intense local remodeling. A striking relationship between these defects and bone sclerosis patterns and complete condylar fractures was made. It was concluded that these were another example of fatigue (or stress fractures) in the racing Thoroughbred.

e) Recognition with computer tomography (CT) that these sclerotic patterns developed in the parasagittal groove area with exercise and that density gradients develop resulting in change in elastic modulus and a subsequent concentration of shear force in this region. Subsequent repair processes lead to a concentration of resorption space, further weakening the bone and predisposing to catastrophic fracture. Recent work at CSU by Drs Marty Drum and Katja Duesterdieck has demonstrated our ability to follow theses changes with CT.

Based on these findings further research in three areas is ongoing.

1) *Investigation of factors that might influence pre-disposition to these fractures in a given horse- Examples of these include*:

    i) Joint and muscle modeling**.** Our group at Colorado State University is collaborating with Dr. Marcus Pandy at the University of Melbourne (an engineer who has modeled the human knee and modeled the forces on the carpus and fetlock joint in the forelimb of the athlete). This includes taking a

multi-faceted approach involving kinematics (gait analysis), CT and MRI to calculate forces across the joint, as well as muscle forces. The working hypothesis is that certain conformations could pre-dispose to injury and these conformations could be manipulated in the clinical patient.

ii) Work at UC Davis by Dr. Sue Stover also involving modeling, particularly of the suspensory apparatus (relevant to fractures of the sesamoid bones) and also involving an instrumented shoe to evaluate forces objectively.

iii) A project currently funded by the Horseracing Betting and Levy Board in England, as well as the Grayson-Jockey Club Research Foundation being done at CSU and the University of Liverpool looking at joint congruency in horses that are fractured with a hypothesis that individual variation and joint congruency (evaluated with finite element modeling) could identify horses predisposed to these injuries.

iv) Genetic work being done at the Animal Health Trust in Newmarket on SNP Analysis (genetic profiling) of horses that fracture compared to horses that don't fracture.

2) *Exercise may manipulate the musculoskeletal system in early ages to make it stronger and decrease the susceptibility to injury (discussed above).*

i) A critical question we are trying to answer in the Global Equine Research Alliance (CSU, Massey University New Zealand, Royal Veterinarian College London, Utrecht Holland) is what is the optimal level of exercise (and when

should it be applied) to have optimal bone remodeling and prevention of injury?

3) *Early diagnosis of microdamage*

   i) Work has been ongoing at CSU with imaging techniques, as well as with fluid biomarkers for the past 10 years. It is well-recognized that nuclear scintigraphy (bone scan) has been used to pick up stress fractures in the humerus, tibia and pelvis and early recognition of these has allowed prevention of numerous catastrophic fractures. These horses are identified by lameness that cannot be localized to the distal limb and the bone scan provides the definitive diagnosis (such fractures commonly cannot usually be diagnosed with radiographs).

   ii) The challenge is to identify the horse that is not lame but has microdamage present and therefore potentially has an incipient fracture. Although we can recognize the density gradients in the parasagittal groove of the fetlock joint (the initial problem that is associated with condylar fractures) with such modalities as CT (and probably also MRI) the problem is to get the horses routinely screened. The use of serum (blood) biomarkers offers the greatest potential to identify a horse at risk in a practical test.

   iii) The principal of fluid biomarkers is that the collagen and proteoglycan components of cartilage and bone breakdown early in the disease process. We have a platform of biomarkers (antibody tests) that can measure the levels of these breakdown products and therefore pick up early degradation and therefore detect early microdamage in cartilage and bone. Work is ongoing to

add genetic and proteonomic biomarkers to this platform. We are currently working with a commercial company to develop a commercial panel that would be available to the equine industry. A number of papers have been published and there are also other papers in press that show that we can identify early damage in the cartilage and bone in the joints, we can distinguish changes in biomarkers with disease in exercised horses compared to exercise alone (biomarkers change with exercise).

iv) In our most recent study funded by the Grayson-Jockey Research Foundation and done in racing Thoroughbreds in Southern California, we found that with sequential blood samples we could pick up changes in biomarkers 6 weeks prior to an injury occurring. Our accuracy in this study was approximately 70%. We are striving to work towards 100% accuracy with these tests. The future vision is that we could identify a horse at risk with monthly sample of serum biomarkers; if that horse has elevated biomarkers, the horse would then be subjected to nuclear scintigraphy and/or a CT scan to find the area of damage. The important factor here is the horse would be taken out of training; most of the microdamage can heal on its own and catastrophic fracture would be prevented.

4. The Role of Rest after Injury

As implied previously, although turn-out and no training has been commonly prescribed as the solution to a horse with injury, newer research questions this dogma. Controlled exercise is needed to keep bone and other musculoskeletal tissues in reasonable condition. While we are still low on the learning curve here, the advent of rehabilitation

programs including swimming, underwater treadmill and other regimens are now an important part to brining horses back into race training.

5. Race Track Surfaces

For many years and in many instances, race track surface has been blamed for musculoskeletal injury in the horse. The recent advent of synthetic tracks has re-initiated a new level of blame on dirt race tracks. There is no question that we have an unacceptable rate of injury in the US. A paper published in the United Kingdom in 2004 cited the overall incidence of fatal distal limb fractures in all types of races to be 0.72/1000 starts (109 out of 151, 901). The incidence was lowest in flat racing on turf with 0.38/1000 starts (29 out of 77,059) and highest in National Hunt Racing with 2.17/1000 (9 out of 417). Flat races run on all weather tracks had a higher risk of injury that flat races run on turf with 0.72/1000 (13 out of 18,178). A number of studies have been done in the US and most recently at the 2008 Welfare Summit; Dr. Mary Scollay data reported 1.47 deaths/1000 starts on synthetics and 2.07 deaths/1000 on dirt tracks. Synthetic tracks, at least based on this preliminary data, decreased fatal injury. In unpublished work by Dr. Jeff Blea and myself in Southern California we observed a significant reduction in non-fatal bone and joint injuries.

On the other hand, synthetic tracks have not served as a panacea and continued work in needed on optimal maintenance of these surfaces. Careful research needs to be done and is ongoing for objective evaluation of these tracks, relating it to real results and defining the optimal methods of track maintenance for the superintendants (including dirt,

synthetics, and turf surfaces). Ongoing research has shown that all synthetic tracks, for instance, are not equal. There is variability and the need for careful analysis maintenance methods. Some manufactures have more experience than others. Ongoing research is a critical part of this effort and clarification of what is real compared to anecdotal.

While anecdotal associations have been made between race track characteristics and incidence of musculoskeletal injury, few scientific studies have been performed. One study in Minnesota made an association between vertical impact to characteristics of the dirt race track and injury (Robinson *et al* 1988, Clanton *et al* 1991).

Proper investigations of tracks require quantitative information describing the surface. Previous track measurements have used some type of light-weight drop test apparatus. The vertical component considered in these studies is the primary force. A second essential element of loading during motion of the horse is horizontal, which depends on the shear strength of the track surface. Dr. Mick Peterson at the University of Maine and myself have been involved in developing tests that would reproduce the loads and speeds of a horses hooves at a gallop and measure the response on a small surface area. As depicted in Figure 1, a specialized system was designed with a hoof shaped impactor (Peterson *et al* 2004) that reproduces the hoof velocity in vertical and horizontal directions and the effect of mass at the moment of impact at a gallop. Sensors on the device record the loads and decelerations on impact with the ground. The system measures the effect of the deeper track layers on the impact load on the hoof. A preliminary study to evaluate the effects of track maintenance procedures that are

commonly used in the western and southern United States on the mechanical properties of the track that are relevant to hoof impact has recently been accepted for publication in the Equine Veterinary Journal.

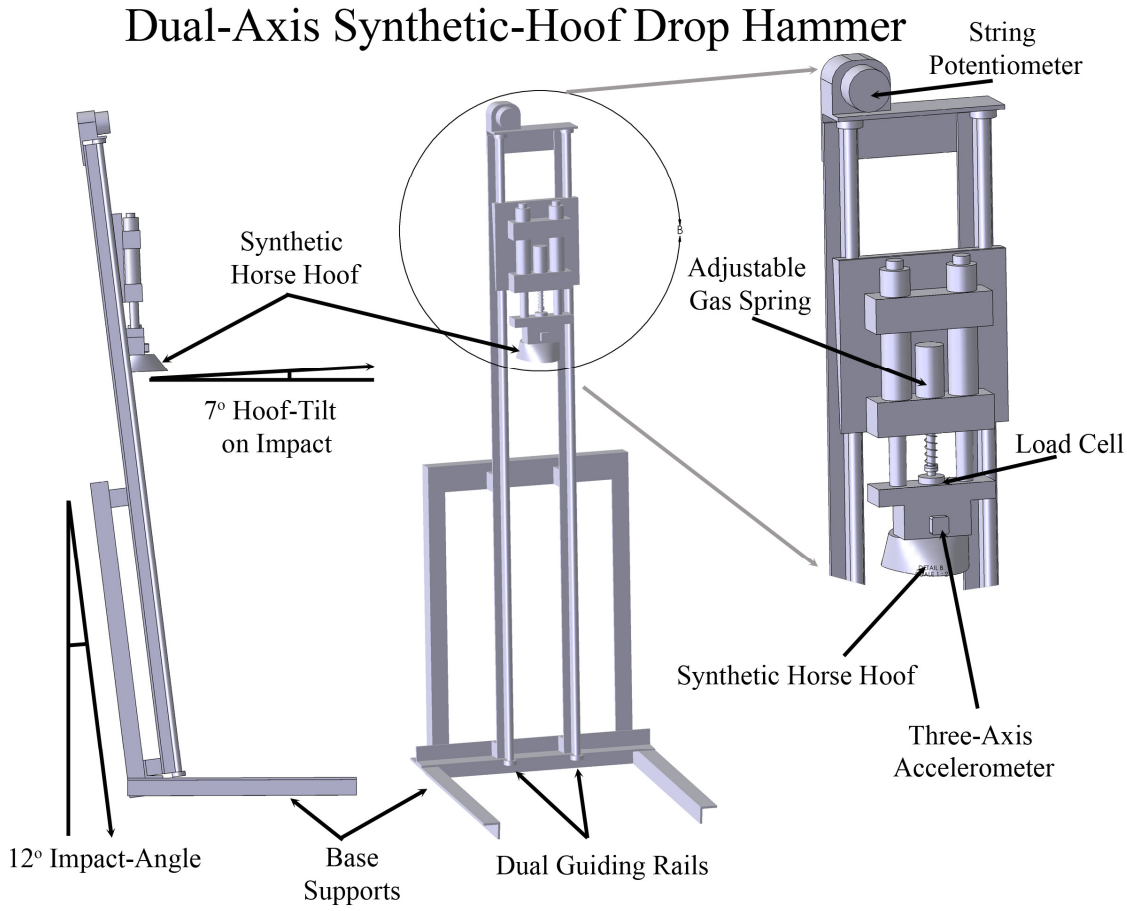

Figure 1: The system shown was developed to replicate loading of the hoof on a track. Figure from Peterson ML and McIlwraith CW. Effective track maintenance on mechanical properties of a dirt race track: A preliminary study. *Equine Vet J* 2008 in press.

In addition, Dr. Peterson has developed a method of measuring the base of the dirt or synthetic race track in terms of slope, as well as irregularity (presence of holes and steps) that has already been used in the practical arena to evaluate race track problems.

The development of both these techniques was initiated before the advent of synthetic tracks to try and support race track management in validating a track as “safe”. Since the advent of synthetic tracks, there has been considerable interest in objective comparison of these surfaces. Such testing mechanisms are a critical part of evaluating tracks objectively rather than anecdotally. Currently an algorithm for testing is being instituted that also involves testing individual track materials with X-ray diffraction and the Welfare and Safety Subcommittee on Track Surface recently voted to develop a laboratory to provide this service to race tracks.

Additional work that has recently been completed is evaluation and change with the Polytrack surface with temperature and how that can be manipulated, as well as the evaluation of the variability within a surface. Monitoring forms have recently been developed for use of dirt, synthetic and dirt tracks. The other significant part of this major research commitment, is epidemiologic data to validate the testing and the characterization of the “ideal” race track with injury rate. In Figure 2 below a chart of the tests which is proposed to manage race track racing surfaces is shown.

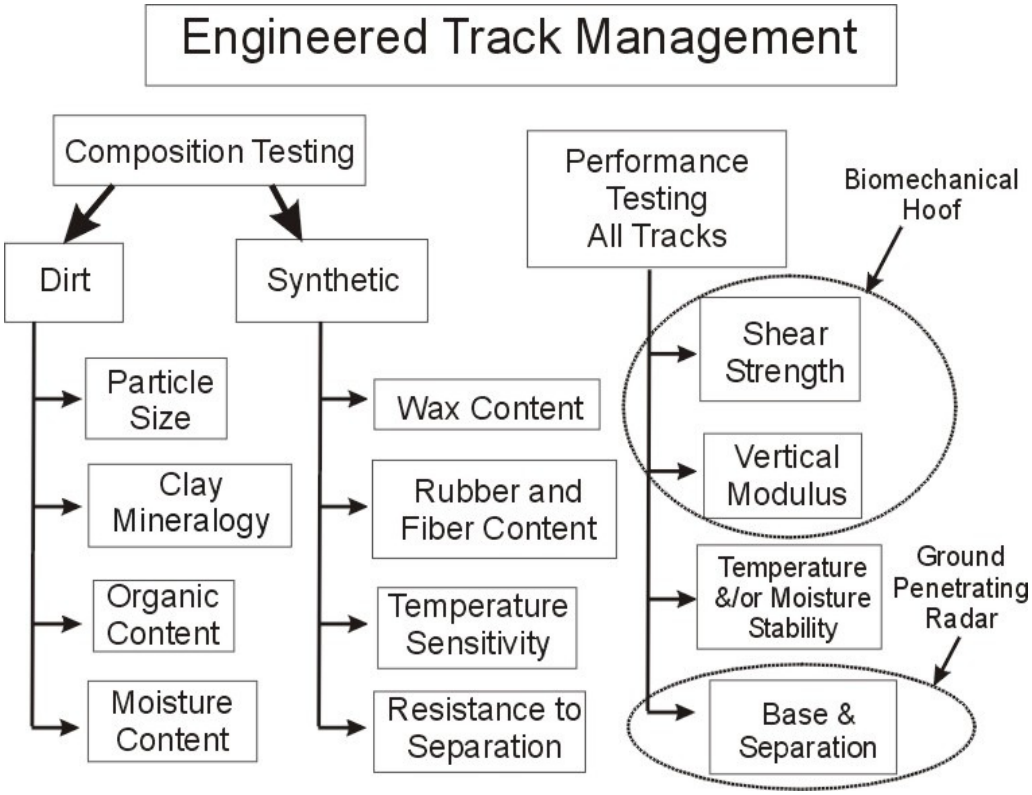

Figure 2: A chart of the tests which can be used to manage racing surfaces.

6. Medication

Medication and more particularly, over-medication have frequently been blamed for our problem. The concept of "the over-medicated, steroid-enhanced horse that is not as sound as before" has been recently espoused. Anabolic steroids are the most recent focus, but we went through a similar situation with the anti-inflammatory drugs and corticosteroids in the mid-1980s. At that time associations had been made in the press to the extent that some people felt that any horse suffering a catastrophic injury must have been injected with corticosteroids. Research in our laboratory examined each of the commonly used corticosteroids and found that two out of three of the common ones were indeed beneficial to joints, but one was deleterious to the articular cartilage. Examination

of that corticosteroid, as well as one of the beneficial ones regarding effect on bone found that neither had deleterious effects on the bone.

Anabolic steroids are currently being addressed specifically by the industry and discussed by other speakers today. It is to be noted that there have been extensive ongoing efforts and history in the area of needed medication. Veterinarians are the primary advocates for the health and safety of all horses involved in racing and are uniquely qualified to lead the discussion on the use of therapeutic medications. Therapeutic medications are legal prescription drugs used to heal or cure medical conditions affecting the horse. The use of therapeutic medication in racehorses is a complex issue. As stated in the AAEP's position on therapeutic medications in racehorses (2000), "In order to provide the best healthcare possible for the racehorse, veterinarians should utilize the most modern diagnostic and therapeutic modalities available in accordance with medication guidelines designed to ensure the integrity of the sport. To this end the following are the essential elements of AAEP policy concerning veterinary care of the horse:

a) All racing jurisdictions should adopt uniform medication guidelines, testing procedures with strict quality controls and penalty schedules that strive to protect the integrity of racing, as well as the well-being of the horse.
b) Stimulants, depressants and local anesthetics or other numbing agents present in a horse at the time of racing should be strictly forbidden.
c) Product present in the horse present at the time of race that has been proven to interfere with accurate and effective post-racing testing should be strictly forbidden.

d) No medication should be administered on the day of race with the exception of furosemide (Salix™). In the absence of a more effective treatment of exercise-induced pulmonary hemorrhage, the AAEP supports the use of furosemide as a day-of-the-race medication for certified bleeders.

Further evidence of the AAEP and its members having a long history of leadership on these issues, the AAEP initiated and coordinated the industries first ever Racing Medication Summit in 2001 (I introduced this meeting as newly elected President). A diverse group of representatives from Thoroughbred, Quarter horse and Standardbred organizations came together with the goal of moving the racing industry to a position of uniformity in the area of medication policy, testing, security and penalties. From this Summit came the formation of the Racing Medication and Testing Consortium (RMTC), an industry supported and dynamic organization that is pursuing policy uniformity on the national level. Dr. Robert Lewis, an AAEP past-President in the current chair of the Consortium.

The Consortium meets four times a year. Thirty-two of 38 states have banned all race day medications, except the anti-bleeder medication Salix™. More recently the Racing Medication and Testing Consortium have suggested that all racing jurisdictions adopted a model to regulate anabolic steroids by January 1, 2009. Three states have already adopted the rule and others are moving the process along. The RMTC, which has no regulatory authority, wrote the model rule in conjunction with the Association of Racing Commissioners International. The use of 1 of 4 anabolic steroids shall be permitted

under the following conditions: Not to exceed the following permitted urine or plasma permitted concentrations. It spells out cut-off times for use of the four steroids which have valid therapeutic purposes and any other anabolic steroids prohibited to be administered.

(1) 16 ß-hydroxystanozolol (metabolite stanozolol [Winstrol])- 1 ng/ml in urine

(2) Boldenone (Equipoise) in male horses other than geldings; including Free Boldenone and Boldenone liberated from its conjugates)- -15 ng/ml in urine

(3) Nandrolone- 1 ng/ml in urine

(4) Testosterone

(a) in geldings- 20 ng/ml in urine

(b) in fillies and mares- 55 ng/ml in urine

(5) Any other anabolic steroids are prohibited to be administered

(6) The presence of more than 1 of the 4 approved anabolic steroids in any concentration is not permitted.

(7) Post-race urine or plasma samples collected from intact males must be identified in the laboratory

(8) Any horse to which an anabolic steroid is being administered in order to assist in the recovery from illness or injury may be placed on the veterinarian list in order to monitor the concentration of the drug in urine. Once the concentration is below the designated threshold, the horse is eligible to be removed from the list.

With the 30- to 45-day cut-off before a race, the steroid would be effectively banned from use on race day. As was recently stated by Dr Rick Arthur, an AAEP past-President and Medical Director of the California Horse Racing Board, “Horses around the world race without anabolic steroids and very successfully. In terms of the sport, I doubt many people are aware that we don’t regulate anabolic steroids. It is going to be difficult to convince the public that Barry Bonds can’t have them, but these animals need them. It is something the racing industry is going to have to face and is facing, I think quite successfully”.